

faces a zone which may be termed the nutritive zone of the acontium; in the immediate neighbourhood of the mesenterial filaments—at the spot where the median swelling alone persists—the epithelium of the septa exhibits a special development, which seems to me to be in direct relation to the nutrition of these organs of secretion.

These physiological facts appear to me to contribute towards clearing up the origin of the convoluted filaments in ontogeny. Heider\*, relying on the identity of their histological structure, admitted the ectodermic origin of the enteroids in *Cerianthus*, and E. B. Wilson† considered it to be very probable that the lateral lobes are the homologues of the ectodermic bands of the Alcyonaria, while in his opinion the central lobe is of an endodermic nature. A. Andres‡ thought that he had succeeded in deriving certain filaments of the Actiniaria from ectodermic proliferations of the stomodæum. But it seems to follow, from certain observations of H. V. Wilson§, that this ectodermic origin ought to be attributed not only to the lateral lobes, but also to the median one, at the very least in the case of the primary mesenteries.

However it may be with regard to supposing, as appears to me to be very probable, that the three lobes composing a typical filament are of an ectodermic nature, it is not less probable that, relying on the identity in histological structure and physiological function, we ought to consider as **endodermic the regions of the filaments which separate the lobes from one another and the nutritive zone of the acontia.**—*Zoologischer Anzeiger*, xvi. Jahrg., no. 409 (January 9, 1893), pp. 10–12.

*On Phagocytosis observed, in the living Animal, in the Gills of Lamellibranch Mollusca*||. By M. DE BRUYNE.

In a communication of Nov. 3, 1891 ('*Annales de la Faculté de Médecine de Gand*'), I mentioned incidentally some phenomena of phagocytosis which had been observed in the normal ciliated epithelium of the gills and mantle of Lamellibranch Mollusks; these observations related exclusively to fixed preparations. Since then I have studied the phenomenon in the living animal, by operating upon four very common forms—*Mytilus*, *Unio*, and *Anodonta*, which are very suitable for this kind of observation, and *Ostrea*, which is much less so, probably on account of the thickness of its gills.

If a fragment of gill be removed from a freshly opened specimen of one of these animals (*Mytilus* by preference), and examined under the microscope, the observer is struck by the clearness with

\* V. Heider, "*Cerianthus membranaceus*," Sitzgsber. Akad. Wiss. Wien, Bd. lxxix. (1879).

† E. B. Wilson, "The Mesenterial Filaments of the Alcyonaria," Mittheil. zool. Stat. Neapel, Bd. v. (1884).

‡ A. Andres, quoted in the foregoing paper.

§ H. V. Wilson, "The Development of *Manicina areolata*," Journal of Morphology, 1889.

|| The investigations were conducted at the Laboratory of Normal Histology of the University of Ghent.

which all the structural details are seen. I have obtained the best results by using Zeiss' No. 4 eyepiece and F objective (magnifying-power 1010). Under these conditions the globules of the blood appear as little amœboid corpuscles with very distinct nuclei. Their protoplasm is sometimes perfectly hyaline, with a few scattered granulations which exhibit an active Brownian movement; sometimes finely granular; or again packed with hyaline globes of variable dimensions, which may or may not contain in their turn some very refringent spheres. The pseudopodia, which may be seen to appear and disappear, are either numerous and delicate, always perfectly hyaline and extended in all directions, or else on the contrary isolated, broad, and true lobopodia. It is possible to follow the blood-corpuscles in their peregrinations; in this way, on the confines of the epithelium, one of these migratory cells is often seen to leave the connective tissue and penetrate between the ciliated cells, separating and depressing them, and thus producing behind it a solution of continuity which goes on increasing. But we soon find that it is something more than a simple separation or depression: the actual substance of the cells is broken into, and exhibits unequivocal signs of alteration. The protoplasm diminishes in places and appears to be eaten away at spots where it has been in contact with a leucocyte. In no case was I able to discover that the amœboid globule here contained fragments of epithelial cells. The question arises whether we have to deal with digestion at the surface of the leucocyte, or at least with dissolution preparatory to digestion. However this may be, a cavity is thus produced which is hollowed out by the leucocytes at the expense of the epithelium. This cavity continues to increase in size, and soon extends to several neighbouring cells; it has very distinct limits, which are sometimes exceedingly irregular, and successively assumes the most varied shapes.

Since it most often happens that the same phenomenon takes place at adjoining spots, the result frequently is that the last remaining cells which still separate the cavities disappear in their turn by the same process; extensive lacunæ are thus formed by means of fusion, in which there move a larger or smaller number of leucocytes, each of which acts as a phagocyte on its own account\*. The free portion of the ciliated cells is most often intact, and there always persists a border constituted by the fragments of protoplasm which have escaped from the devastation. The body of the phagocytes grows considerably, in most cases becomes packed with hyaline spheres, and continues to move freely in the lacuna. Here and there they finally cross the border itself at some spot or other, and leave the lacuna to reach the surface of the branchial mucous membrane; where they are speedily carried away by the current which is produced in the water by the motion of the vibratile cilia.

The very interesting phenomenon which I have just described, and which, so far as I am aware, has not hitherto been recorded,

\* In these lacunæ it is also not unusual to meet with one or more leucocytes which have come from the depths, and are charged with matter of a yellow or dirty brown colour.

is in the living animal usually observed only in the epithelium of the lower (free) border of the gills (it also occurs pretty frequently in the buccal tentacles); but in most cases, over the entire extent of the epithelium, it is possible to witness the penetration of blood-corpuseles, which come from the lacunar connective tissue and are charged with granulations or hyaline spheres of variable, and sometimes very considerable, dimensions. They advance slowly, thrusting out pseudopodia between the epithelial cells, and thus opening a path for themselves to the free surface, where they undergo the same fate as those which leave the lacunæ: *i. e.* they are carried away by the current. The presence of phagocytes among the epithelial cells has recently been mentioned by Dr. Janssens ('*La Cellule*,' t. ix.).

It may be asked what is the physiological object of this phenomenon. Without pretending to solve the question at present, and reserving to myself the right of reverting to it at greater length, I wish to point out one way of looking at it. In preparations fixed by means of Flemming's or Hermann's fluid, I have often discovered, either in the phagocytes, or in the tissues, the presence of degenerate leucocytes. They appeared in the most varied shapes; but they were always composed of a sphere or of an irregular body, but little or not at all stainable, and serving as a substratum for one or more corpuseles which took a decided saffron stain: the substratum was of protoplasmic origin, the chromatic element was derived from the nucleus. In the same way in the phagocytes, the spheres, which were hyaline in the fresh state, seemed, from their low degree of colourability, to be composed of more or less altered protoplasm. Given these details, the question arises whether it would not be possible to find in the present case an application of the views of Metschnikoff and others, on the subject of a continual strife between the cells of the same organism, which results in the sweeping of the tissues, and in the removal of anatomical elements which are enfeebled, sickly, or decaying, by means of amoeboid cells still in the full vigour of active life. The phagocytes which have come from the depths and contain spheres or coloured matters would have loaded themselves with fæces and dead cells, met with in their diapedeses, and would transport them to the exterior through the epithelium; on the other hand, the migratory elements which hollow out the epithelium would have been summoned thither by chemiotaxy: the vibratile cells of the lower border of the gill-lamellæ are, by their very position, more than all the others exposed to all kinds of destructive influences; as a consequence they would rapidly become worn out and enfeebled, and their debilitated bodies would attract the leucocytes.

N.B.—The way in which the tissues thus injured are renewed still remains to be examined; this will form the subject of investigations to which I intend to devote myself later on. In conclusion, I do not think it necessary to dwell upon the fact that the lacunæ, which have been mentioned so often in the present communication, cannot be confounded with the lattice-like clefts, which permit the passage of the water into the interbranchial spaces.—*Comptes Rendus*, t. cxvi. no. 2 (Jan. 9, 1893), pp. 65-68.